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Essay

Ethics-Based Computer Science in Bilingual and Multicultural Schools

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Abstract: For decades, schools have adapted to a technologically-dependent world—developing courses, faculty positions and curricula to begin explicitly teaching with and about technology. Recognizing the need for deepening education in this area, the Lycée Français de New York, a bilingual and multicultural school, developed the digital learning department to lead the school's thinking and practice around technology and computer science education. Over time, the department shifted its focus from first only the use of computer applications, to an emphasis on computer programming, to a more recent era which includes technology ethics as an equally important area of study. In serving a bilingual school, the Lycée's digital learning team adapted teaching methods for a bilingual student body. The multiculturalism of the school presents the opportunity for fertile ethics discussions, since cultural values often impact values regarding technology use.

Keywords: ethics; computer science; bilingualism; multiculturalism; technology

1. Introduction

Given the current speed of technological change, the proliferation of technology into personal spaces and the young age at which children first encounter technology, the educational community needs to shift our priorities and our discourse in reference to technology and computer science education. This essay aims to encourage computer science educators to focus significant time and energy on ethics in order to foster student development of habits and attitudes that support healthy relationships with technology.

This essay is structured to first explore the background of technology and computer science education and then explains how the evolution of the field impacted the experience of one bilingual and multicultural school, the Lycée Français de New York.

The section that follows will discuss the challenges and opportunities of teaching technology with an ethical focus while also immersing students in multiple languages and cultures. Differences in linguistic backgrounds, cultural norms and legal systems often impact the development of values regarding what is ethical. Exploring these value differences can unearth key realizations about beliefs regarding technology use and design.

Finally, the essay will advocate for the need for more student voice in ethics-based computer science and technology education. Much of the technology that students use currently will be drastically changed or obsolete by the time they reach the workforce. Therefore, it is imperative that teachers engineer learning experiences that help students develop strategies regarding how they use technology now, not how they anticipate they might do so in the future.

2. Background

The work of educators has changed dramatically in the Internet age. Teachers and professors are no longer considered to be the sole sources of information, the only providers of skill development,

nor the only sounding board for critical feedback. Where we have previously likened students to "empty vessels" (Rodriguez 2012, p. 177), all Internet users and children especially, are now more accurately compared to "drinking from a fire hose"—inundated with information, various forms of media and buzzing and blinking notifications (Stover 2000, p. 45). Given this reality, teachers maintain a critical role in assisting children in developing the skills necessary to navigate this always-on media environment and an ever increasingly technologically dependent world.

The field of computer science and technology education has evolved substantially over recent decades to accommodate the quickening pace of technological development and societal expectations regarding the workforce. For years the focus of the field was preparing a "technologically literate labor force" (Apple 1992, p. 47) and then in the late 2000s "preparing students for jobs that don't even exist yet" (Su 2009, p. 167).

Gone was the idea that students would succeed in school, go off to college, study in one area and work in that field for the rest of their lives. The role of educators shifted towards the ambiguous duty of preparing students for an unknown future in a technologically-dependent world. What resulted was a national emphasis on STE(A)M (the integration of science, technology, engineering [arts] and math) and 21st century skills.

In his 2009 article "STEM, STEM Education, STEMMania," Mark Saunders provides a history of STEM. The term "STEM" grew out of a program from the National Science Foundation in the 1990s, to create an acronym for science, technology, engineering and math (Saunders 2009, p. 20). In 2005, Thomas Friedman included a warning in The World is Flat, claiming that Chinese and Indian advances in STEM would leave Americans behind in global competitiveness. What followed was a flurry of activity from business and government. In 2007, the National Science Board wrote a STEM action plan and in the same year, the National Governors Association targeted funding for STEM education (Saunders 2009, p. 25). In fact, in his 2011 State of the Union Address, President Barack Obama promised, "And over the next 10 years, with so many baby boomers retiring from our classrooms, we want to prepare 100,000 new teachers in the fields of science and technology and engineering and math" (Obama 2011).

During the same decade, economists, educators and business leaders examined how the rise of advancing technology would affect the American workforce. Autor, Levy and Murnane argued that computerization would replace the jobs of those performing routine manual and cognitive tasks and technology would aid those who were conducting "nonroutine problem solving and complex communications tasks" (Autor et al. 2003, p. 1279). Such a shift would require schools to emphasize new skills. In 2009, the Partnership for 21st Century Skills published the "vision for 21st century learning", working with parents and experts across educational sectors and business (Kay 2010, p. xvi). In addition to traditional academic skills, this model emphasizes "learning and innovation skills"—communication, collaboration, critical thinking and creativity, along with "information, media and technology skills" (Partnership for 21st Century Learning 2015).

3. Computer Science and Technology Education at the Lycée Français de New York

The Lycée Français de New York was founded in 1935 and is a pre-K through 12th-grade bilingual, multicultural school on the Upper East Side of Manhattan. Combining American and French curricula in one program, each year at the Lycée, over 1300 students learn with faculty who represent francophone and anglophone countries throughout the world.

By the early 2000's, the field had already accepted that students would need technology skills to succeed in future careers (Apple 1992, p. 47) and the Lycée began to transform learning and teaching to prepare students appropriately. The Lycée purchased and installed SMART Boards for each classroom, trained teachers and offered technology classes for students in grades 1–7.

In recent years, the Lycée has experienced three major eras in our computer science and technology education philosophy. The first era was that of treating technology as a support tool for other subjects.

Technology classes (not computer science classes at that time) focused on teaching students to navigate and use computer applications such as Microsoft Word or PowerPoint.

In 2012, the Lycée piloted its first 1:1 device program, providing individual iPads to 6th grade students who chose to study Italian as their foreign language. Following notable results in the pilot study (Rocca 2015), the Lycée embarked on a gradual 5-year rollout of a 1:1 device program. Students in grades 3–8 use iPads (only taking them home in grades 6–8) and students in grades 9–12 are each required to bring a laptop to school. The goals of this program are to (a) foster technological productivity and the inclusion of 21st century skills in students' academic work and (b) teach students to develop critical skills related to being responsible for a device (e.g., device care, balancing time on and off the device, staying focused on the task at hand). The digital learning team philosophy was and still is that students need to have hands-on experience with the devices. Students need to live through both successes and pitfalls within a safe environment, to help them hone their skills before they leave the safety net of school.

With the introduction of the 1:1 program and teachers becoming more accustomed to teaching with technology, the use of computer applications became more prominent in other subject areas. Therefore, these skills no longer needed to be the focus of computer science instruction. From about 2012–2017, the aim of the computer science program gradually shifted away from teaching students how to use computer applications and moved towards a focus on computer programming. In 2012, the Lycée introduced object-oriented, block-based programming in the most advanced computer science class, which at the time was in grade 7. Block-based computer programming was rolled out in the elementary levels over time, allowing for middle school students to move to text-based languages and create more sophisticated projects.

In recognition of a greater prominence and purpose for computer science and digital learning as a discrete subject area, in 2013, the Lycée created the digital learning department—committed to enriching and equipping student learning through the integration of technology. The department *enriched* work of learning in all areas of the school through providing tools and training that faculty could use to achieve domain-specific learning goals. Digital learning *equipped* students with the skills necessary to succeed in a technology-dependent world by teaching computer programming, media production, media literacy and digital citizenship.

From the years 2013–2017, the digital learning department focused on preparing students for jobs that did not exist yet, by assuring that they had critical skill development in STEAM and 21st century skills, enriching education and equipping our students for the technologically-dependent unknown. In 2016, the Lycée expanded mandatory computer science courses through grade 9, with electives rolled out gradually in grades 10, 11 and 12 over the next few school years. Also in 2016, the Lycée opened a media lab, (to prioritize media literacy and media production) and a Makerspace (to prioritize design and fabrication with a combination of high and low-tech tools).

In early 2017, a few members of the Lycée attended the NYSAIS (New York State Association of Independent Schools) Education & Information Technology conference with other independent school technologists and technology educators. One of the speakers, Tristan Harris, former design ethicist at Google, spoke about the intentional persuasive design of social media and websites, seeking to gain and maintain user attention (Harris 2017). Given adolescent brain development and the resulting novelty reward-seeking behavior (Siegel 2014), the educators present recognized that students would likely be significantly affected by the design decisions made by technology and social media platforms.

The digital learning department at the Lycée began to reconsider its mission and work. The concern was two-fold. First, the department faculty wanted to assure that students were informed and engaged consumers, introspective and aware enough to recognize how and why technology companies seek to influence behavior. Second, the digital learning team recognized that the students we teach will likely influence the current or future technological landscape in their roles as designers, executives or users. Our goal is to assure that as future designers, our students have a grounding in ethics. We adopted the mission of "helping students become conscious consumers and human-centric designers of

technology". We intentionally reprioritized, holding four areas of practice in equal esteem—computer science, citizenship and ethics, technology for productivity and making and media. See Figure 1 for a visual representation of this work.

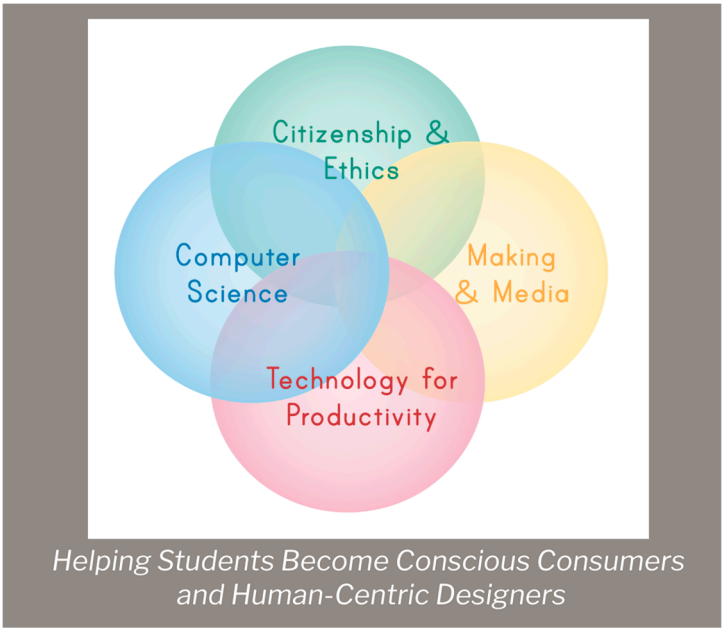

Figure 1. Digital Learning at The Lycée Français de New York (Charrel et al. 2019).

4. Challenges in Teaching Computer Science in a Bilingual Environment

Though most of the faculty at the Lycée Français de New York are bilingual in English and in French, not all of the members of the digital learning team are. However, the department is committed to meeting the needs of all students, regardless of the language profile of the student or the teacher. Monolingual and bilingual teachers use a number of strategies to reach bilingual students. They provide key vocabulary in both languages (see Figure 2 for an excerpt of a presentation to students about parts of the computer), translate instructional material into both languages and faculty often allow students to turn in work in the language in which they are most comfortable. Therefore, teachers use a variety of strategies or models to accommodate varying language abilities.

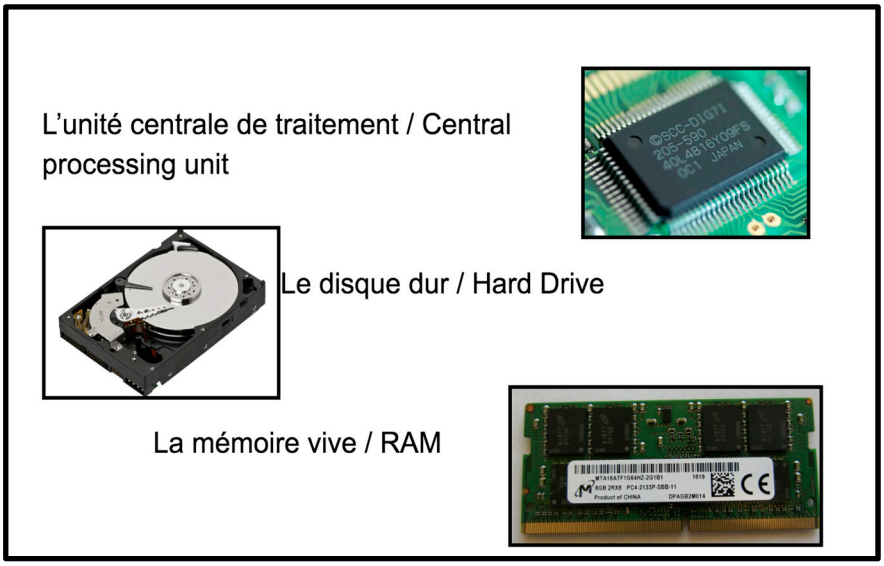

Figure 2. Example of definition of terms in French/English (Flora 2018) Class Notes.

Obviously, preparing lesson materials in more than one language takes extra time, a precious resource for teachers. This challenge is evident, especially when teachers develop a new unit and teach it for the first time. Similarly, grading student work in a language in which the teacher is not fluent takes a great deal of time and effort. Teachers often find a colleague to assist with bilingual grading. Additionally, the department is exploring peer-assessment opportunities, where students can provide feedback to one another, which tend to alleviate some linguistic obstacles.

When ethics is introduced to the curriculum, nuanced language is important to convey meaning appropriately. Therefore, both monolingual and bilingual teachers need to approach the work of translating content thoughtfully and carefully.

5. Multiculturalism as an Asset to Teaching Technology Ethics

Codes of ethics are influenced by culture. The bilingual and bicultural nature of the Lycée provides the opportunity to explore the intersection of culture, ethics and technology. One example of an international set of standards, created by the International Society for Technology in Education, remains quite vague regarding whose definition of ethics is necessary for students to understand. Standard 2b, under the "Digital Citizen" category, states that "Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices" (International Society for Technology in Education 2016, emphasis mine).

At first glance, this standard may be fairly straightforward, albeit a tall order and a teacher in a monocultural environment could design a myriad of lessons to help students work towards this goal. In a multicultural environment, this work is much more complex. At the Lycée, we need to consider how technology use can be interpreted in both the American legal and ethical system (largely focused on individual rights and freedom of expression) and the French legal and ethical system (with a much greater focus on individual privacy). In doing so, teaching legal and ethical behavior related to technology becomes an interesting way to evaluate how values get formed across cultures and how these values influence the design and use of technology. And what follows is often that, technology, in turn, influences cultural values and norms.

An example of differences in cultural values affecting attitudes towards the use of technology could be illustrated through two 2016 articles—one from *The Telegraph* and one from *The Atlantic*. In *The Telegraph*, French legal experts predicted that it may be possible for French children to sue their parents for posting pictures of them online as minors—resulting in a hefty fine and even jail time, if the child wins the suit (Chazan 2016). Contrast this idea with reporting from *The Atlantic*, which revealed that 80% of American children under two-years old already have a presence on social media (Lafrance 2016).

In a bicultural environment, the responsibility of the computer science or technology teacher is to take advantage of the value differences across cultures and examine them with students. Allow students to play the role of the technology designer and determine how these values might or should impact the design of new tools or the redesign of existing technology. Such ethical conversation allows students to develop empathy skills, as well as user-experience skills that will impact their ability to design culturally-inclusive technology. The Lycée continues to explore how best to practically apply the intersection between culture and ethics and this topic will be the subject of future study.

6. Student Voice as a Requirement

In this field particularly, students face challenges that are unfamiliar to adults. Teachers must listen to their students, provide room for them to explore their passions and ideas in student projects and let them express their frustration with the technologically-dependent world in which they have always lived. At the Lycée, we give freedom of exploration and expression in a number of ways:

With our youngest students, we develop a culture that does not punish them for bringing their curiosity or concerns to adults. We are proactive in teaching students that they are likely to find something that makes them feel uncomfortable. When they do, they should not fear being punished

but rather they should tell a trusted adult. If teachers punish students for their Internet searches, children will be reluctant to show their teachers when they find shocking or disturbing content. In such a punitive environment, students will learn that they should process their (often difficult) emotions alone and the teachable moment will be missed.

In middle school, we create projects that require students to delve deeper into the technology they use every day. Students keep diaries of their technology use, analyze their results and discuss the implications of their findings. Eighth graders choose a social media platform to explore and investigate the implementation of persuasive techniques within that platform. Finally, the students provide alternatives that they hypothesize would improve the well-being of users.

Our high school students explore concepts such as data analysis and they are asked to examine the impacts of more cutting edge technologies such as artificial intelligence or virtual reality.

Most importantly, children of all ages need room to make mistakes and to learn from these mistakes. These essential moments are the most teachable, allowing students to develop stronger skills based on their past failures. In her 2015 book, *The Gift of Failure*, Jessica Lahey points out, through a series of evidence that "gritty students succeed and failure strengthens grit like no other crucible" (Lahey 2015, p. xxi).

7. Conclusions

In the field of computer science and technology education, teachers are trying to hit a moving target. The technology will continue to change at faster rates and our understanding of human brain development will continue to deepen. Therefore, it is important that we step back and examine what is truly valuable about our work, what we hope our students will remember long after they leave our classrooms and long after the tools we use are obsolete.

Part of this work is to provide technical skills and problem-solving strategies. Though, in the author's opinion, more importantly, the work is to assure that we are helping students develop habits and dispositions that will provide them with a foundation for remaining human in an automated world. As Lycée Français de New York third-graders learn, people have choices about their technology and media habits. However, people are designing technology to constantly becoming more skillful in guiding the user's choice in a specific direction. We seek to give students agency over their own behavior, so that they are controlling their technology, not the other way around.

In bilingual and bicultural teaching contexts, schools will need to examine what the teaching of computer science and technology looks like, both in terms of linguistic teaching methods as well as explicitly teaching how cultural differences can impact user behavior and beliefs. Providing students with this foundational understanding will hopefully allow them to be more empathetic and globally-minded as they begin their own careers.

And last, we must stop dictating and do more listening—welcoming mistakes. Our students are the most technologically connected generation. Let's allow them to be introspective and reflective, so their connections can add value for all of us.

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